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THE HISTORY OF MOUNTAIN GOAT MANAGEMENT IN THE KOOTENAY REGION OF BRITISH COLUMBIA

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Fish and Wildlife Branch
Ministry of Environment
Cranbrook, B.C.

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Mountain goat hunting is a long-time tradition in the East Kootenay. Pictured above is a 1934 hunting party in the west side of the Elk River valley with Andy Billy on the right and two unknown partners. This Bulletin is dedicated to Andy Billy.

ABSTRACT

Mountain goat populations in the Kootenay suffered a severe decline during the 1960's. Management data available at that time are presented: regulations, hunter numbers, harvest, success, sex ratios in the harvest, and some age class data from game checks. Until 1971, no downward trends in harvest, success, sex ratios, or age class structure were discernible. Based on a subjective knowledge of the situation, seasons were reduced and area closures instituted from 1966 on, with the season finally being closed in 1972. In 1973, the Hunter Sample data were reanalyzed and compiled by watershed. The pattern of harvest distribution that emerged indicated that over-exploitation of goat herds began as early as 1960 in some watersheds. The decline of goat harvest that resulted in these areas was masked by increasing harvests in other watersheds where new roads made previously unhunted herds accessible. This combination of declining and increasing harvests produced Management Area harvest totals which remained relatively constant. The continuous expansion of access, together with inadequate data analysis, animal inventory, and regulations allowed the maintenance of a high goat harvest by progessive exploitation and decimation of previously unhunted herds. Exploitation of goat herds from other parts of British Columbia and from Alberta are described and were found to be due to increased hunting pressure caused by uncontrolled access development. Some evidence was also found to indicate that productivity of hunted goat herds was reduced by harassment during the long hunting seasons of the 1960's. It was concluded that massive over-harvest of goat populations occurred as a result of: 1. a philosophy of maximum harvest, prevalent among biologists and administrators of that period; 2. a lack of sufficient management input; 3. a lack of understanding of the vulnerability of the species; and, 4. the proliferation of uncontrolled access.

FOREWORD

A note of explanation is in order for this Fish and Wildlife Bulletin. This report was prepared as a technical document in 1973, but languished in files rather than being published as originally planned. Now it has become apparent that this type of document has a historical value as well as its original technical merit: many of the original sources of data are no longer available. Recognizing these values as well as realizing that progress in the wildlife field depends upon the communication of findings, the report has been resurrected for publication.

The original manuscript has been changed only slightly. Most revisions were editorial so that the manuscript would conform to conventions of the technical publication manual. Measurements were converted to their metric equivalents. Content of the report was left unchanged. The report does not relate its findings to current literature but rather, to that literature up to 1973 regarded as relevant by the authors.

D. Eastman, Co-editor,
Technical publications.

1983, April

INTRODUCTION

During the past twenty years, populations of the Rocky Mountain goat (Oreamnos americanus) have declined markedly in the southern two-thirds of the Kootenay Region of British Columbia. Populations did not appear to be responding to a shortened hunting season, lower bag limits, and males only restrictions. By the mid-1960's, it was evident that existing management was inadequate. The objective of this study was to analyze all past data collected on goats in the Region and to determine the direct cause of the decline in goat populations.

For the sake of brevity in publishing this report, it has been summarized to describe only the cause of the decline in goat populations in the Kootenay Region. Other possible factors such as habitat decline, severe weather conditions, and disease were investigated, and objectively and rationally dismissed. There was no evidence to suggest that any of these causes contributed to the population decline.

The authors wish to express sincere thanks to Mrs. I. Paron, Mrs. B. Standeven and, especially, Mrs. L. Foxall for typing of manuscripts. We also wish to thank those Conservation Officers who provided information on access roads and goat numbers.

STUDY AREA

The study area embraces all of the Columbia River drainage in British Columbia (Fig. 1). The main topographic features are a series of north-south mountain ranges separated by deep valleys. The valleys lie between 400 m and 915 m in elevation and are 1825 m to 2440 m below the mountain peaks. These mountain ranges are part of two upland systems - the Columbia Mountains and the Rocky Mountains. The Columbia system is composed of three major ranges - the Monashees west of the Arrow Lakes; the Selkirks, between Kootenay Lake and the Arrow Lakes, running north to Big Bend; and, the Purcells, between Kootenay Lake and the Rocky Mountain Trench. The Rocky Mountains consist of several smaller, broken ranges, all east of the Trench. Although both systems have rugged relief, they are fundamentally different. The Rockies are composed of sedimentary rocks which have been folded and tilted; the Columbia Mountains were formed by the upheaval of thick layers of lavas and sediments prior to the formation of the Rockies (Holland 1964). Both systems were heavily glaciated during the Pleistocene. Glaciation is primarily responsible for the productivity of the present alpine areas. The erosion of alpine cirques and basins, cirque lakes, horns, and hanging valleys, has contributed to soil formation and slope stabilization. Remnant glaciers remain today, especially in the Columbia system, since that system is closer to the Pacific air masses and receives almost twice as much precipitation as the Rockies.

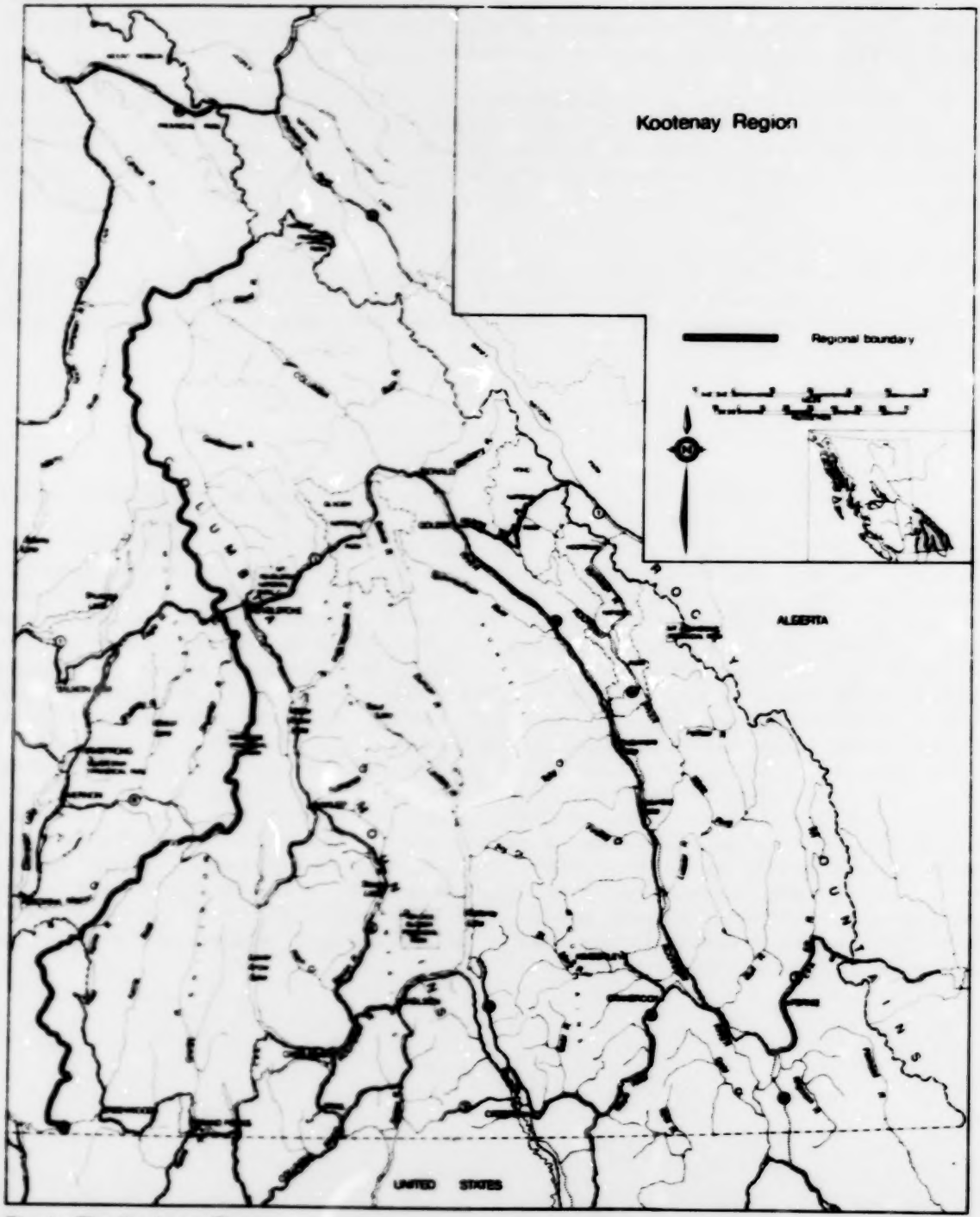

Fig. 1. The Kootenay Region.

METHODS

All available data relevant to goats in the Kootenay Region were reanalyzed. Past hunting regulations were used for seasons dates, restrictions, and closures. Licence sales were compiled from Fish and Wildlife Branch revenue statements. Estimates of goat hunter numbers were taken from Hunter Sample reports for 1962 to 1970. The resident harvest was obtained from the Hunter Sample for all years. Non-resident harvest was taken from guide return files in the Nelson office for 1963 to 1971.

Returned Hunter Sample questionnaires, retained in the Cranbrook office, were manually reworked for 1963 to 1971, to provide estimates of harvest in sub-units of Management Areas (M.A.) 9, 10, and 11. These M.A.'s have since been converted to the new Management Unit (M.U.) system (Fig. 2). The same data were used to estimate harvest rate over the season.

The Kootenay Region access development map (Fig. 12) was compiled by comparing 1952 and 1962 map editions. The 1972 map was developed through discussions with Conservation Officers, Forest Rangers, guides, and sportsmen.

HISTORICAL REVIEW, 1800 - 1955

The earliest known reference to goats in the study area comes from the journals of David Thompson (Hopwood 1971), while he was camping in the winter of 1807 at the mouth of Toby Creek. He wrote:

> "The goats with their long silky hair were difficult to hunt, from their feeding on the highest parts of the hills, and the natives relate that they are wicked, kicking down stones on them."

Later, he relates:

> "As soon as the mountains were passable, I sent off the clerk and men with the furs collected, among which were one hundred of the mountain goat skins with their long silky hair, of a foot in length of a white colour, tinged at the lower end with a very light shade of yellow. Some of the ignorant self-sufficient partners of the Company ridiculed such an article for the London market; there they went and sold at first sight for a guinea a skin, and half as much more for another lot, but there were no more."

Several other early authors commented on seeing goats in the Kootenays, including Coleman (1912), Wilcox (1906), Outram (1905), and Wheeler (1905). Wheeler also noted the use of goat skins for blankets by the Indians.

Grohman (1900) observed goats on Akokli Mountain and around the north end of Kootenay Lake. He comments that:

> "...the true home of this game (the goat) is British Columbia, especially the Kootenay district, in the eastern - most portion of that province, where the animal appears to grow rather larger than in the coast ranges of British Columbia."

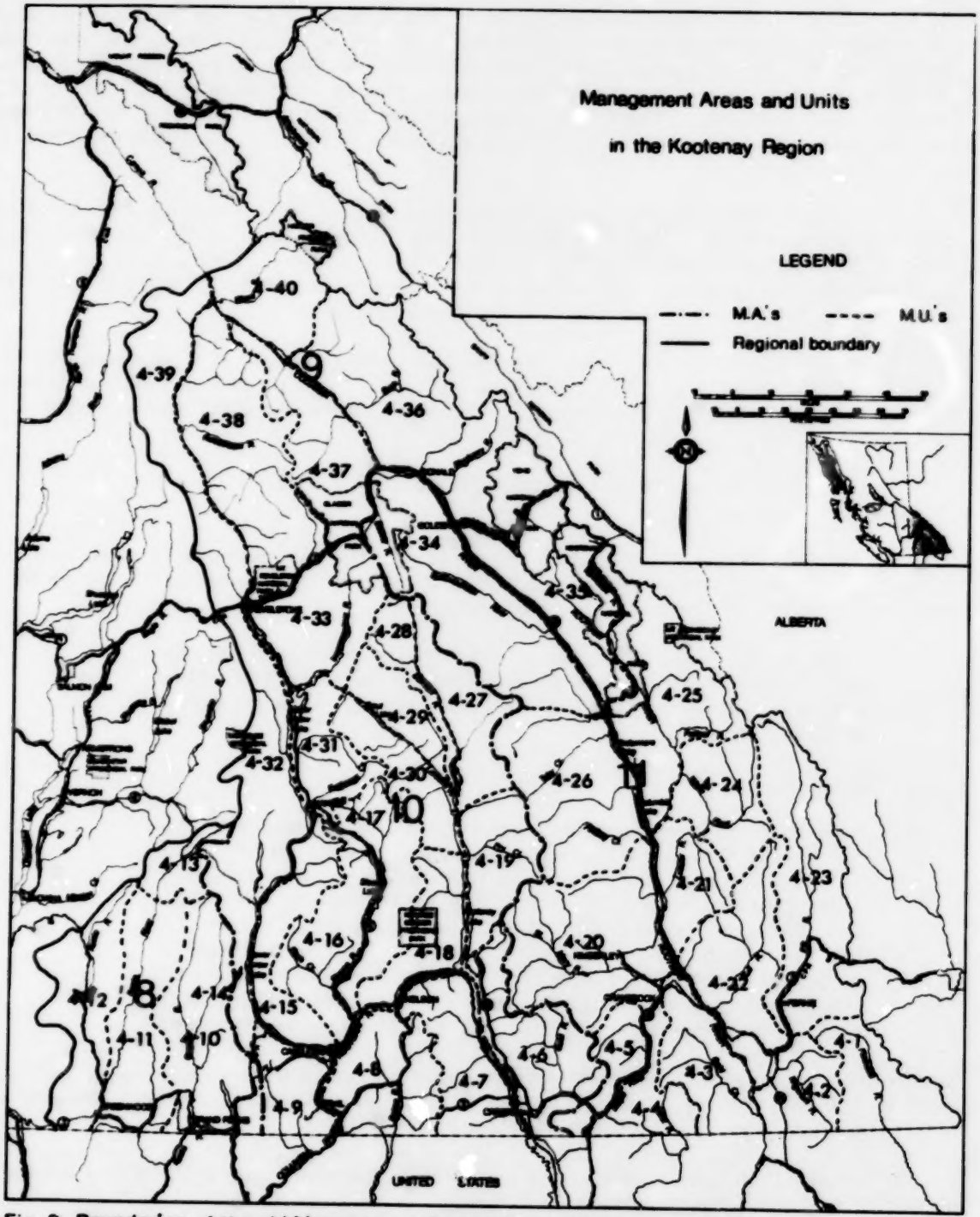

Fig. 2. Boundaries of the old Management Areas and new Management Units.

Of the earlier writers, Hornaday (1906) is the most descriptive. On a thirty day trip in 1905, Hornaday's party observed 239 individual goats in the Crossing Creek, Brulé Creek, and upper Bull River areas. At that time, the bag limit was five goats, reduced to three shortly thereafter.

The annual reports of the Game Branch (Anon. 1973), beginning in 1915, indicate little interest in goats or goat hunting at that time. In 1948, there is the first evidence of concern over goat populations, when the bag limit was reduced from two to one. In 1949, a decline in goat populations along the Rocky Mountain Trench is mentioned and, in 1951, the decline is discussed again. By 1956, it was noted that: "...the goat was vigourously hunted and the kill was considerable" (Anon. 1973).

From 1956 to 1963, goat hunter numbers and harvest increased quickly, followed by a strong decline which resulted in closure of the season in 1971 and provided the impetus for this report.

RESULTS

DISTRIBUTION, ABUNDANCE, AND MOVEMENTS

The general distribution of goats follows that of the alpine zone (Fig. 3), though in some areas, winter ranges are located at lower elevations. Certain mountain blocks in the Rockies and Purcells provide almost continuous goat habitat; however, the heavily glaciated nature of the northern ranges and the lower average elevation of ranges in the West Kootenay result in a more discontinuous distribution of goat habitat in those areas (Fig. 3).

The late winter distribution of goats in some areas was documented by observations made during aerial surveys (1965 to 1975) carried out in the Elk, Bull, White, and Palliser drainages. Other goat surveys were carried out along the Monashees between M.A.'s 8 and 10 in 1971 and, in 1972, along the northern Monashees between M.A.'s 9 and 15. In Alberta, Jamieson (1969) and Collins (1969) classified goat habitat and located some relict herds remaining in the Highwood and Kananaskis areas, adjacent to B.C. Annual surveys of these herds have been carried out since 1971 by the Wildlife Inventory Unit in Alberta.

The number of goats observed during Fish and Wildlife Branch surveys varied from zero in some years to 92 in 1973. The results are of little value except to delineate some winter range requirements. We have no effective measure of goat populations; however, based on a subjective but conservative population density of 8 goats per 10 square kilometres (two goats per square mile) and given alpine habitat of 4600 square kilometres (Canada Land Inventory), a <u>potential</u> population of 3600 goats has been suggested for M.A. 11. A subjective knowledge of present goat herds provides an estimate of 1700 goats for M.A. 11 and 4500 goats for the entire Region.

Seasonal movements of goats consist primarily of dispersion through the alpine in summer and concentrations on south exposures and wind-blown ridges for the winter. Kuck (1973) found that radio-equipped goats in southern Idaho rarely moved more than 5 km though a four year old male moved 16 km. More extensive movements were found for three yearling males in the Crazy Mountains of Montana

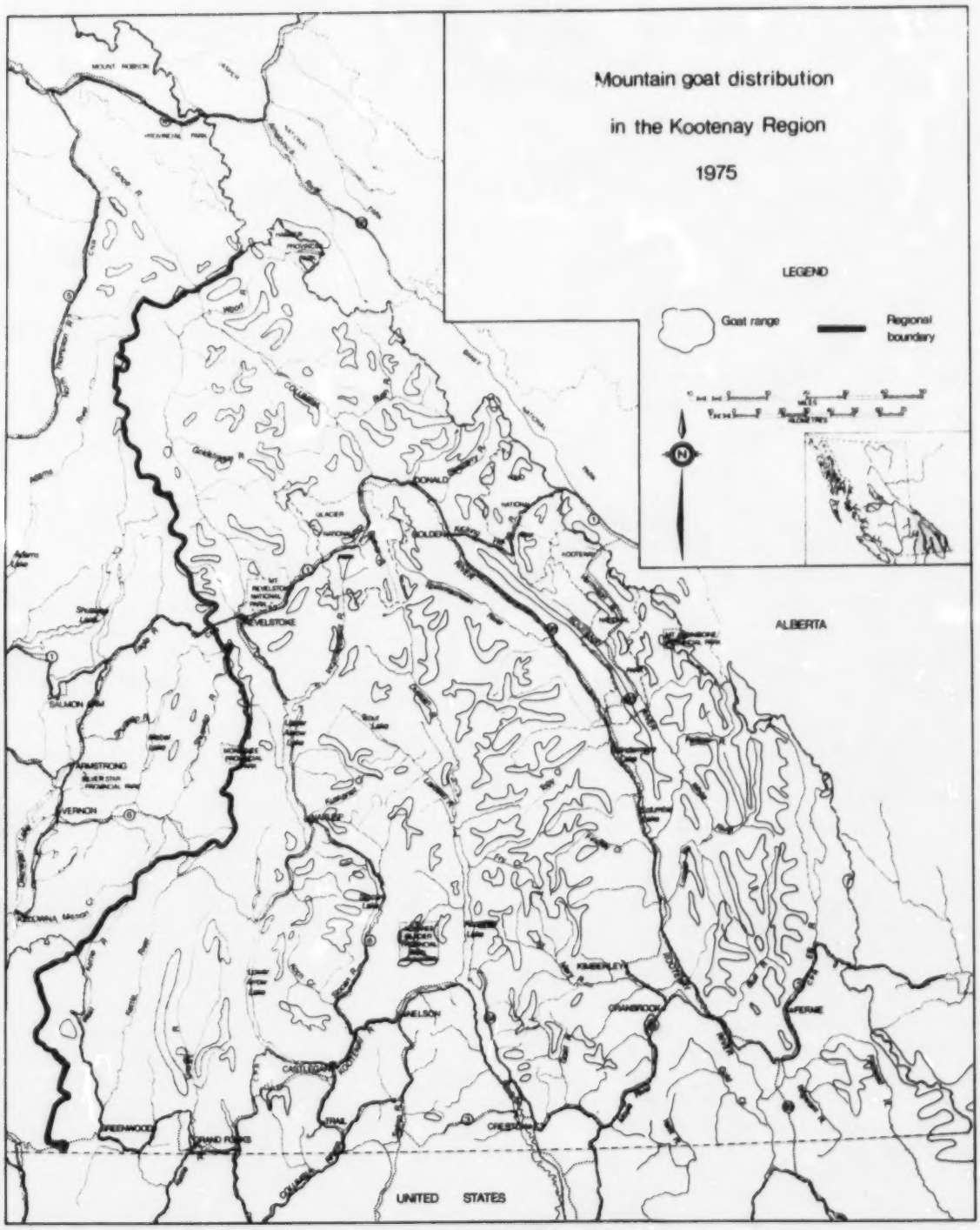

Fig. 3. Mountain goat distribution in the Kootenay Region, 1975.

(Lentfer 1955), indicating perhaps a pioneering element present in the population. However, in other areas, goats regularly move great distances (16 to 24 km) to make use of salt licks, apparently due to salt hunger resulting from the extensive use of succulent, low sodium content vegetation during spring and early summer (Hebert 1967).

HABITAT

Summer ranges for goats are, of course, extensive, limited only by the availability of escape terrain. In winter, however, the available habitat is restricted. Aerial surveys located 23 winter ranges in the southern Rockies. Goats were found in small groups (maximum of 11, $\bar{x} = 4.6$) and appeared to move very little over the winter. Winter ranges consist of cliff areas on south exposures (1645 m to 1890 m), often well below treeline, and wind-swept ridges, cliff bases, and talus slopes at higher elevations (2195 m to 2620 m). Surprising numbers of goats have been observed on north exposures, for reasons not understood at this point. In Coyote and Crossing Creeks, goats were observed wintering with bighorn sheep.

Ogilvie (1968) provides a description of alpine plant communities in the Rockies. Of these, the Elymus innovatus[1] association of south-facing avalanche slopes, the Kobresia bellardii association on exposed south-facing slopes and ridge crests, the Dryas hookeriana - Oxytropis podocarpa association on wind-exposed, snow-free ridges, and the Stonefield lichen association on wind-exposed summits and high ridges, are probably of importance to many goat populations. The Elymus innovatus association is based on colluvial chernozemic soils, the others on shallow regosols.

Though it has not been studied, we suspect that the much higher precipitation in the Purcells, Selkirks, and Monashees may result in alpine communities, and thus, goat ranges, that are very different from those of the Rockies. Subalpine communities on south-facing slopes are also of importance in some areas as winter range; in the West Kootenays, we observed that some herds drop down almost to the levels of Kootenay, Slocan, and Arrow Lakes (430 m to 520 m) in a manner similar to some coastal goat herds (Rutherglen, pers. comm.).

Up to the present, human activity has had little effect on goat habitat. Fires in the early part of the century may have been beneficial, creating seral grass and forb communities on winter ranges. One goat winter range, Mt. Wardle in Kootenay National Park, appears to be declining in productivity due to forest succession on seral grass communities.

Mining activity resulted in disturbance in many areas and coal strip-mining activities may have affected some goat habitat. Logging in high subalpine areas may also have had an effect. In general, goat habitat remained the most stable of all ungulate habitats in the Kootenays and the decline in goat populations probably could not be attributed to loss of habitat or reduction of habitat quality.

NATURAL MORTALITY

Predation was not documented as an important factor in goat survival due to their habitat preference, though predation around salt licks has been noted (McCrory 1965). Observers also noted goat mortality due to falls, avalanches, rock slides, and other natural hazards.

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[1]Scientific nomenclature based on Hitchcock and Cronquist (1973).

Parasitism and disease in goats have been documented by Cowan (1951), Brandborg (1955), Kerr and Holme (1966), DeBock (1971), and others. In the East Kootenay, the decline of goat populations coincided with a major bighorn sheep die-off from a lungworm-pneumonia complex (Demarchi and Demarchi 1969). In some areas, such as the Moyie drainage, the Trail-Rossland area, the east shore of Kootenay Lake, and the Front Ranges of the Rockies, goat herds disappeared prior to the bighorn sheep die-off. It appeared unlikely, therefore, that the goat decline could be attributed to the lungworm-pneumonia complex.

Another potentially important mortality factor, a selenium deficiency or white muscle disease, was recorded in goats by Hebert and Cowan (1971). This disease causes mortality under stress conditions and its effects are difficult to document. It may have played an important, but unknown, role in the goat decline.

Severe winters are known to drastically reduce kid production and yearling survival in goats (Anderson 1940; Boddicker et al. 1971; Brandborg 1955; DeBock 1971; Hjeljord 1973). Winter severity, especially snow depth, is a very important factor controlling goat populations.

Weather data from the Kimberley Airport were used as a measure of winter severity in the Rocky Mountain Trench (Table 1). Higher than average precipitation and lower than average monthly temperatures correlate well with a subjective knowledge of ungulate survival on major winter ranges in the Trench. No equivalent data were available for the alpine areas where goats winter; however, March and April snow depths from nine snow courses in the alpine do correlate with the Kimberley Airport data, indicating that the winters of 1961-1962, 1964-1965, and 1968-1969 were severe for ungulates both in the alpine and in the Trench. It is likely that these severe winters contributed significantly, both directly (winter losses) and indirectly (lost recruitment), to the goat decline.

A further problem was suggested by R.A. Rutherglen, Conservation Officer and long-time resident of Nelson. He had observed a moderating of winters in the West Kootenay over the last few decades. His supposition was given support by data from the Nelson weather station. The mean winter temperature (December to March) increased from -1.5°C for the period 1903 to 1935, to -1.0°C for 1935 to 1950, and to -0.3°C for the period 1950 to 1970 (Table 2). This last increase, to just below freezing temperatures, probably resulted in the most obvious expression of the moderating trend - the lack of freezing on the west arm of Kootenay Lake.

If this moderating effect resulted in wet snow or rain falling on alpine goat winter ranges, as suggested by Rutherglen, then goat numbers may have declined as a result, since wet snow would not blow off the ridges as lighter, drier snow would. An attempt was made to check alpine weather conditions with data from Old Glory Mountain near Rossland and Fidelity Mountain in Glacier National Park; however, the data were insufficient to draw any conclusions. This moderating effect may be a long-term, or cyclic event, as discussed by Edwards (1956). In either case, it may act as a controlling factor on goat populations.

Table 1. Winter climatology data for the Kimberley Airport, 1960-1969.

	Dec				Jan				Feb				Mar				Apr			
	Ppt	Temp(°C)			Ppt	Temp(°C)			Ppt	Temp(°C)			Ppt	Temp(°C)			Ppt	Temp(°C)		
Year(s)	(mm)	Mean Max	Mean Min	Mean	(mm)	Mean Max	Mean Min	Mean	(mm)	Mean Max	Mean Min	Mean	(mm)	Mean Max	Mean Min	Mean	(mm)	Mean Max	Mean Min	Mean
1960-1961	20.3	-4.9	-12.4	- 8.7	21.3	- 1.7	-10.3	- 6.0	51.1	3.1	- 5.1	-1.0	23.9	7.0	- 3.8	1.6	15.7	10.6	-1.2	4.7
1961-1962[1]	46.0	-4.4	-13.1	- 8.8	35.6	- 5.4	-15.1	-10.3	19.8	0.3	- 8.4	-4.1	14.5	4.6	- 7.6	-1.5	9.9	15.3	-1.1	7.1
1962-1963	26.9	1.0	- 5.5	- 2.3	18.0	- 8.8	-18.9	-13.9	19.1	5.7	- 5.6	0.1	21.3	8.6	- 4.3	2.2	15.7	13.0	-1.2	5.9
1963-1964	33.8	-4.1	-11.6	- 7.9	38.6	- 1.4	-10.2	- 5.8	1.3	2.0	-11.7	-4.9	13.2	3.3	- 8.3	-2.5	18.0	11.2	-1.5	4.9
1964-1965[1]	74.2	-6.9	-15.3	-11.1	29.2	- 1.8	-10.6	- 6.2	23.1	1.1	-10.0	-4.5	6.6	4.1	-11.2	-3.6	18.3	14.5	-0.4	7.1
1965-1966	43.4	-1.3	- 9.8	- 5.6	41.7	- 3.5	-11.8	- 7.7	9.9	1.8	-11.4	-4.8	21.8	5.9	- 6.4	-0.3	15.7	12.1	-1.9	5.1
1966-1967	21.3	0.3	- 7.0	- 3.4	34.5	0.8	- 9.1	- 4.2	18.3	3.4	- 8.4	-2.5	43.9	3.9	- 6.9	-1.5	3.3	11.1	-3.2	4.0
1967-1968	26.2	-3.0	-11.3	- 7.2	39.4	- 2.1	-12.2	- 7.2	10.4	5.1	- 7.4	-1.2	10.9	9.9	- 3.3	3.3	33.5	11.2	-3.7	3.8
1968-1969[1]	81.0	-6.2	-14.6	-10.4	61.7	-11.2	-21.6	-16.4	21.8	-0.7	-13.1	-6.9	3.8	6.4	- 7.2	-0.4	-[2]	-	-	-

[1] Severe winters

[2] Data not available

Table 2. Mean winter temperatures at the Nelson weather station, 1904 - 1970.

Year(s)	Mean Temperature (°C)				Mean Winter Temp (°C)
	Dec	Jan	Feb	Mar	
1904-1935	-2.6	-4.3	-1.8	2.7	-1.5
1935-1950	-1.1	-4.3	-1.6	3.2	-1.0
1950-1970	-1.1	-2.6	0.0	2.5	-0.3

HARVEST

Seasons and Regulations

Past goat management consisted primarily of manipulation of season duration and bag limits (Appendix A). The season, 91 to 95 days up to 1965, was reduced in length as concern over declines grew. Partial area closures were instituted in 1963 for M.A. 10 and, in 1968, for M.A. 11. A male only season was instituted in M.A. 11 in 1969 and in all of the Region in 1970. The season was finally completely closed in M.A. 10 in 1971 and in M.A. 11 in 1972. A short, either sex, season continued in M.A. 9 through to 1974.

A similar progressive closure of goat seasons occurred in adjacent portions of Alberta. All areas south of the Trans-Canada Highway, except the Kananaskis, were closed in 1968. The Kananaskis closed the next year. The neighbouring states of Montana, Idaho, and Washington had for some time closely controlled permit systems for goats.

Goat Hunters

Total licence sales and resident hunters hunting in the Kootenays reflect the increase in bag limit and the opening of the Granby watershed (previously closed) in 1957 (Fig. 4). From that point on, licence sales and goat hunters increased, doubling between 1955 and 1963. From 1963 on, sales and hunters declined, as harvest and success dropped, seasons were reduced and closures instituted. By 1969, licence sales and hunters had dropped to pre-1955 levels. This decline in hunters occurred primarily in M.A. 11, which provided the majority of the available goat hunting. Goat hunter populations in M.A. 10 remained constant until 1968; in M.A. 9, they increased from 1966 on. For non-B.C. residents, it was not possible to calculate the number of licences sold, since resident and non-resident purchases were not separated in earlier years. The sale of non-B.C. resident big game licences in M.A. 11 is presented in Fig. 4 as an index of the number of non-B.C. residents hunting goats since the majority of them hunted in M.A. 11.

Most goat hunters were Kootenay residents: 71 percent in M.A. 9, 89 percent in M.A. 10, and 82 percent in M.A. 11. Non-Kootenay residents came from all portions of the province, primarily the Coast and the Interior (Appendix B).

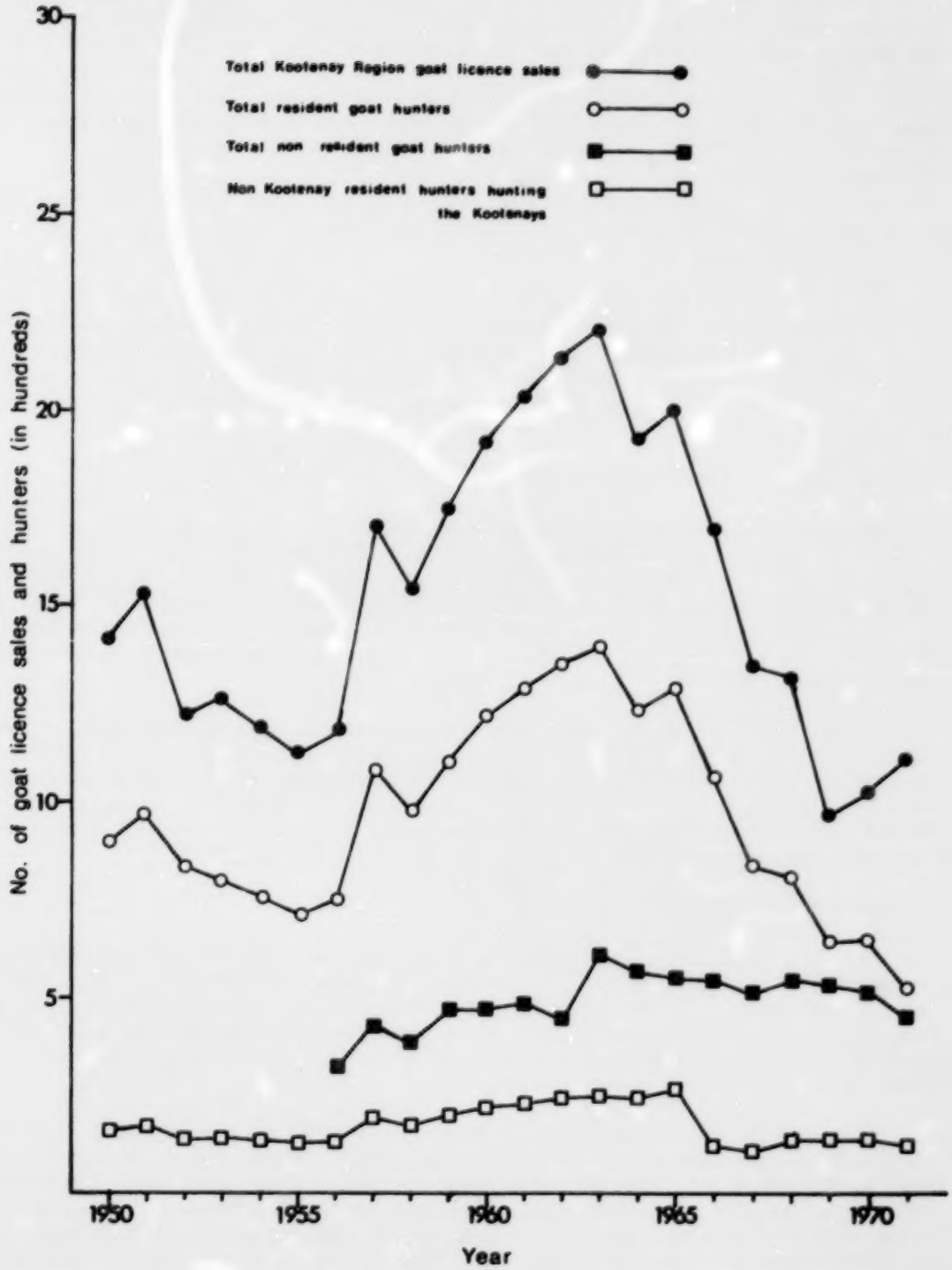

Fig. 4. Goat licence sales and hunters in the Kootenay Region.

Harvest

Goat harvest by Management Area is presented in Fig.5. The majority of the harvest came from M.A. 11. Non-resident harvest contributed an average of 26 percent of the total M.A. 11 harvest (Appendix C). Harvests in M.A.'s 9 and 10 were only a small part of the total harvest. Significant increases in harvest occurred in 1952, 1957, 1960, 1963, and 1968 (Fig. 5). The 1957 increase resulted when the bag limit was increased to two goats, and the Granby watershed in M.A. 8 opened. In 1963, the White River Game Reserve was opened and, in 1968, harvest increased due to an early opening of the season (August 21). No explanation is available for the 1952 and 1960 increases; they may be due to the small sample available from earlier years (Appendix D).

Success

Resident hunter success (Fig. 6) are highest in some years in the 1950's, more stable in the early 1960's, then declined in 1966 before increasing again in 1968. No distinct decline in success was discernible until 1970. Non-resident success was undoubtedly higher, but was not calculated since no estimate of non-resident goat hunters was available.

Sex Ratios in the Harvest

Sex ratios in the resident harvest are presented in Table 3. In M.A. 9, there was an increase in the male segment between 1963 and 1968 from 75/100 to 166/100. In M.A. 10, the male component was variable, from 78/100 to 380/100, but consistently higher than in other areas, perhaps indicating a greater selectivity for males by West Kootenay hunters, or less early season vulnerability of females. In M.A. 11, the male component was also variable, 108/100 to 166/100, though not to the degree of M.A. 10.

Up to 1965, all goats harvested by non-residents, as reported in the guide returns, were males. The proportion of males was 92 percent in 1965 and 81 percent in 1966. The selectivity of guides and non-residents declined in 1967 and 1968 to 64 percent and 73 percent, respectively. A males only season with a short female season was instituted in 1969, and the proportion of males increased to 88 percent, then to 91 percent in 1970, and to 95 percent in 1971.

Game Check Data

Checks operated at Kimberley and Cranbrook provide limited data on goats (Appendix E). The sex ratio of checked animals compared well with the Hunter Sample estimates. A chi-square test calculated for estimates from 1962 to 1969 indicated that there was no significant difference between the estimates at the five percent level of precision. Some age data were collected from horn annuli; however, no trends were discernible.

Appendix E and Table 4 are a summary of the data available to the Regional Wildlife Biologist during the 1960's. During that period, there were reports of the over-exploitation of specific goat herds and, from 1963 on, closures were instituted, usually after the fact. However, given the level of precision available in management data at that time, it was not possible to justify widespread closures, or restrictions of seasons. Up until 1968, there was no discernible decline in harvest in any of the three Management Areas. Resident hunter success

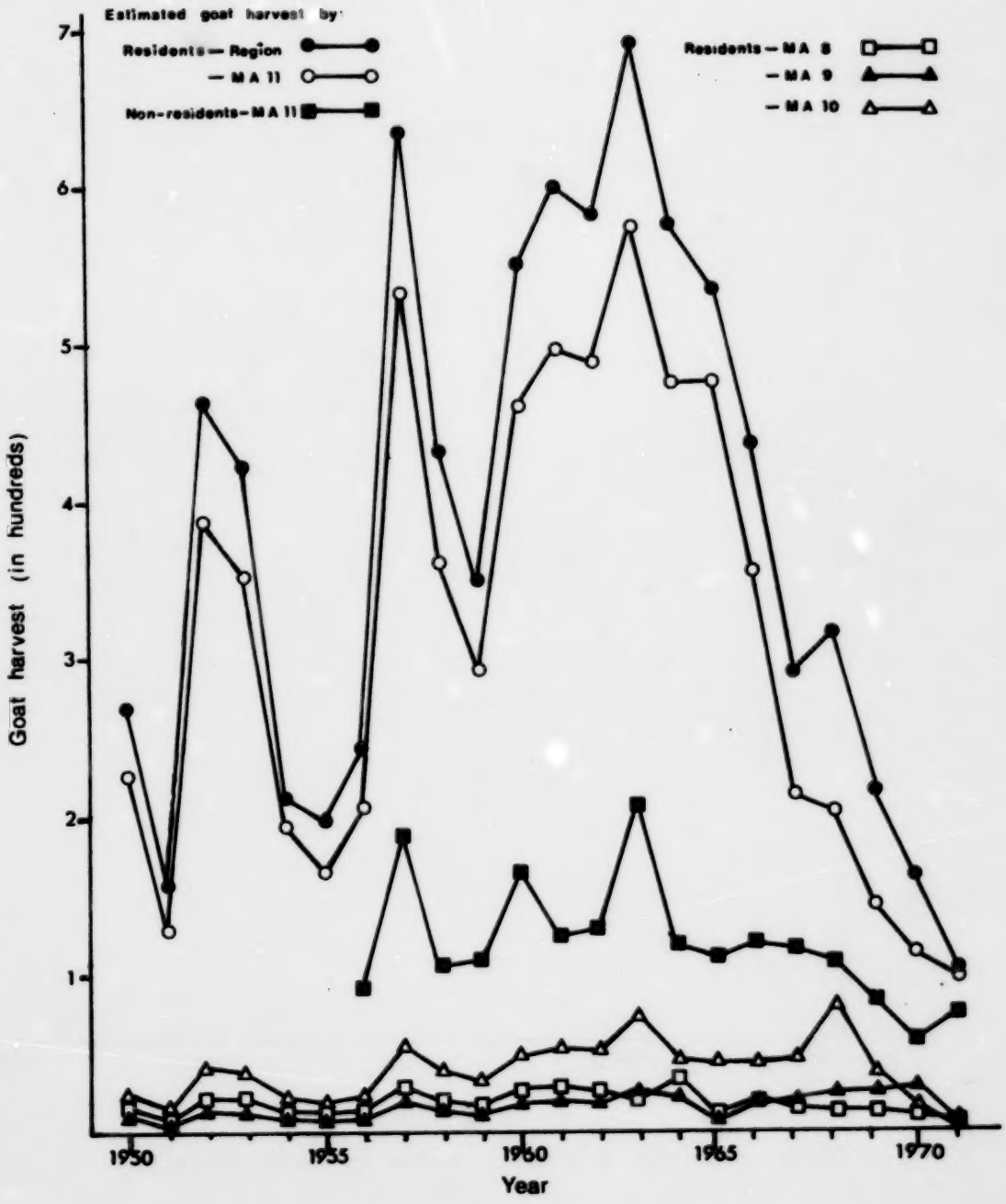

Fig. 5. Goat harvests in the Kootenay Region.

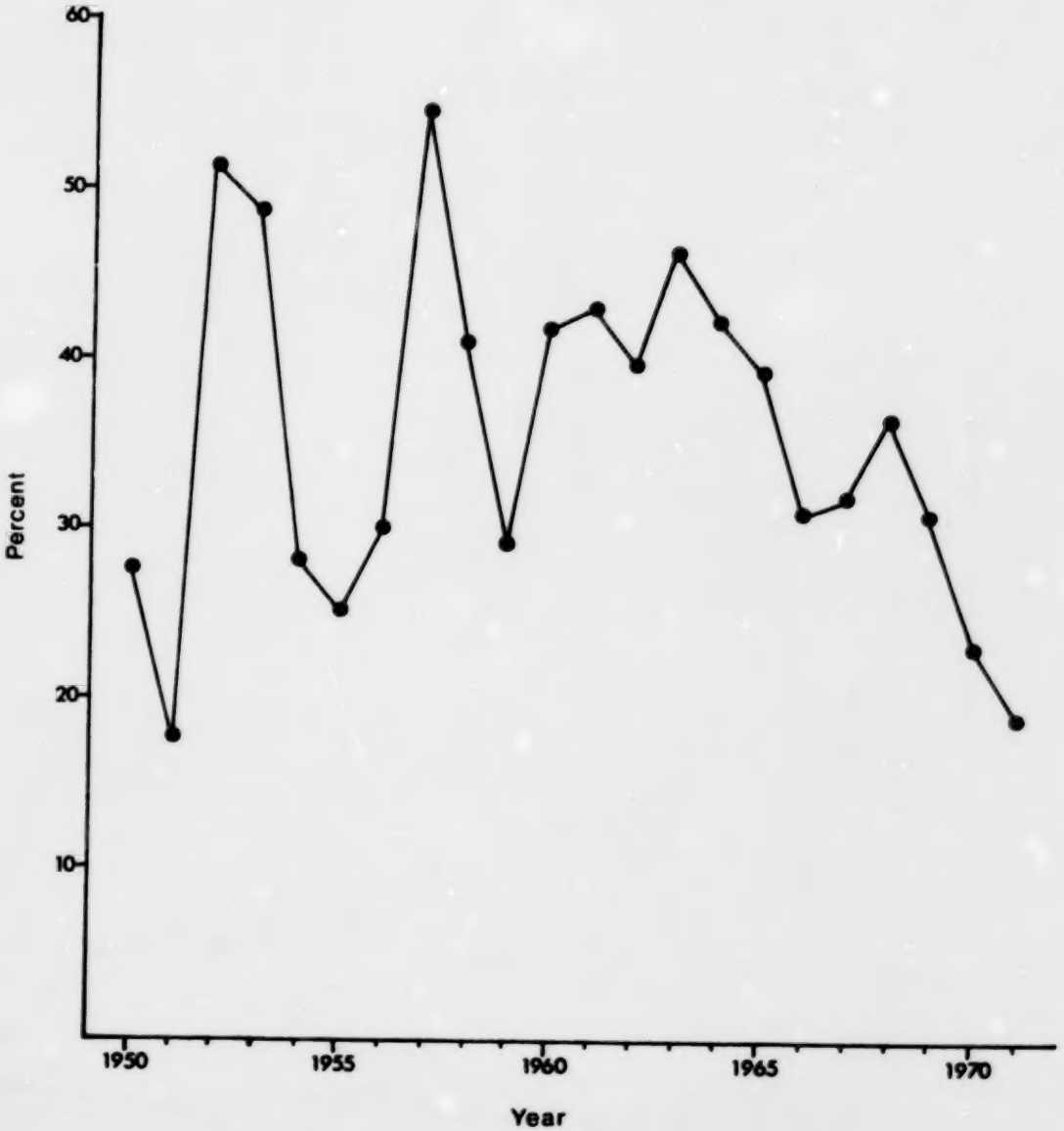

Fig. 6. Resident goat hunter success in the Kootenay Region.

Table 3. Male, female, and juvenile components[1] of reported Resident Goat Harvest

Year	M.A. 9 M	F	Juv.	Sample Total	M.A. 10 M	F	Juv.	Sample Total	M.A. 11 M	F	Juv.	Sample Total
1963	75	100		14	147	100		42	129	100		335
1964	83	100		11	175	100	25	24	108	100		249
1965	100	100		2	125	100	25	20	146	100	9	220
1966	133	100	33	8	260	100		18	137	100	12	149
1967	150	100	50	6	78	100		16	166	100	4	78
1968	166	100		8	380	100		24[2]	144	100	4	67[3]
AVERAGE												
1963-1968	118	100	14	8	194	100	8	24	138	100	6	183
1969	140	100		12	350	100		18	306	100		69
1970	71	100		12	no female season			7	no female season			53
1971		100		12	no season			0	no female season			

[1] Sex ratio based on 100 females

[2] 3 u/c goats not included

[3] 2 u/c goats not included

Table 4. Non-resident goat harvest in M.A. 11, 1956 - 1971.

Management Unit	Goat Harvest by Year															
	1956[1]	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
ROCKIES																
4-01 Flathead									9	9	2	3	12	0	1	1
4-02 Wigwam									5	2	0	9	4	1	1	3
4-22 Bull									26	17	25	6	12	17	5	14
4-23 Elk									11	21	24	27	15	19	10	10
4-21 Lussier									0	0	0	0	0	0	0	0
4-24 White/Upper I																
4-25 Kootenay I									25	12	26	28	26	16	21	18
4-35 Beaverfoot									15	12	10	25	11	10	11	15
4-36 Blaeberry/Bush[2]									0	2	0	0	6	1	7	9
Total									91	75	87	98	86	64	56	70
Purcells																
4-03 Gold									0	0	0	0	0	0	0	0
4-04 Yahk									0	0	0	0	0	0	0	0
4-05 Moyie									0	4	3	3	3	1	0	0
4-20 St. Mary's									0	0	0	2	1	7	4	4
4-26 Horsethief/ Finlay									29	29	27	11	20	11	3	8
4-34 Spillamacheen									0	2	1	0	2	0	0	0
Total									26	35	31	16	26	19	7	12
Overall total M.A. 11	96	187	104	108	164	122	126	204	117	110	118	114	112	83	63	82

1 data were not compiled by M.U.'s for 1956 - 1963
2 previously in M.A. 11, now in M.A. 9

remained high, the male component in the harvest was constant or increasing, and the available age data showed no trends. It was, therefore, difficult to justify the closures demanded by hunters and guides especially in view of the philosophy of maximum harvests held by many wildlife biologists and administrators of that period. Based on a subjective knowledge of the problem, attempts were made to limit harvest through a progression of reduced seasons, area closures, and "billies only" seasons. Finally, in 1972, the season was closed in M.A.'s 10 and 11 and part of M.A. 9.

DOCUMENTING THE DECLINE

Distribution of the Harvest

To obtain more detailed information on the spatial distribution of the harvest, the Hunter Sample cards were reanalyzed and compiled by sub-units of the old Management Areas, units roughly comparable to the new Management Units (M.U.'s) (Fig. 2; Appendix D). Data are presented according to the new M.U. system. For M.A.'s 9 and 10, the data were grouped by four-year time periods due to the small sample size. As can be seen in Fig. 7, this analysis provides a totally different picture of the harvest from that presented by the Management Area analysis. Total harvest for M.A. 9 showed a slight increase over the 1959-1970 time period, but this is made up of declines in the Blaeberry and Kinbasket areas (M.U.'s 4-36 and 4-40), masked by a large increase in harvest in the Goldstream unit (M.U. 4-38) during 1967-1970, through the influx of people associated with the construction of the Mica Dam.

Total harvest for M.A. 10 (Fig. 8) was also relatively constant. However, this was made up of declines in harvest in some units: M.U.'s 4-8, 4-18, 4-17, 4-32, and 4-6; and increased harvests in other units: M.U.'s 4-16, 4-15, 4-31, and 4-33. Fig. 9 shows a similar situation for M.A. 11. A major decline is discernible in the total Management Area harvest from 1967 on, but this was made up of declines which began as early as 1961 in M.U.'s 4-1, 4-20, and 4-22. These declines were masked by increased harvests during the 1962 to 1965 period in M.U.'s 4-26, 4-35, 4-23, 4-24, and 4-25. Most of this increased harvest was provided by the opening of the White River Game Reserve in 1963. Units within this Reserve produced an estimated 374 of the 566 goats harvested in M.A. 11 that year. Thus, on a Regional basis, there were declines in several watersheds beginning as early as 1960, but these declines were masked by increasing harvests in other areas. It was not until herds in these areas began to decline in the late 1960's that any significant decline in total harvest figures occurred.

Non-resident hunters also contributed to the decline. When non-resident harvest (from the Guide Returns) was calculated by M.U. (Table 4), large fluctuations in some units are shown, particularly M.U. 4-26. An exploitation of some goat herds was indicated in several M.U.'s where the non-resident goat harvest decreased during the period 1964 to 1971 (Table 4).

It was possible to document the decline of two separate goat populations. The Granby River watershed was closed to goat hunting until 1957. In that year, it was opened and a continuous check kept for three years on the only access road. As indicated in Fig. 10, both harvest and mean age of the animals checked dropped over the three year period. A more detailed case is presented for the White River herd (Fig. 11). The harvest data presented were for the entire Rocky Mountain region, east of the Trench, while the age data included some animals from the

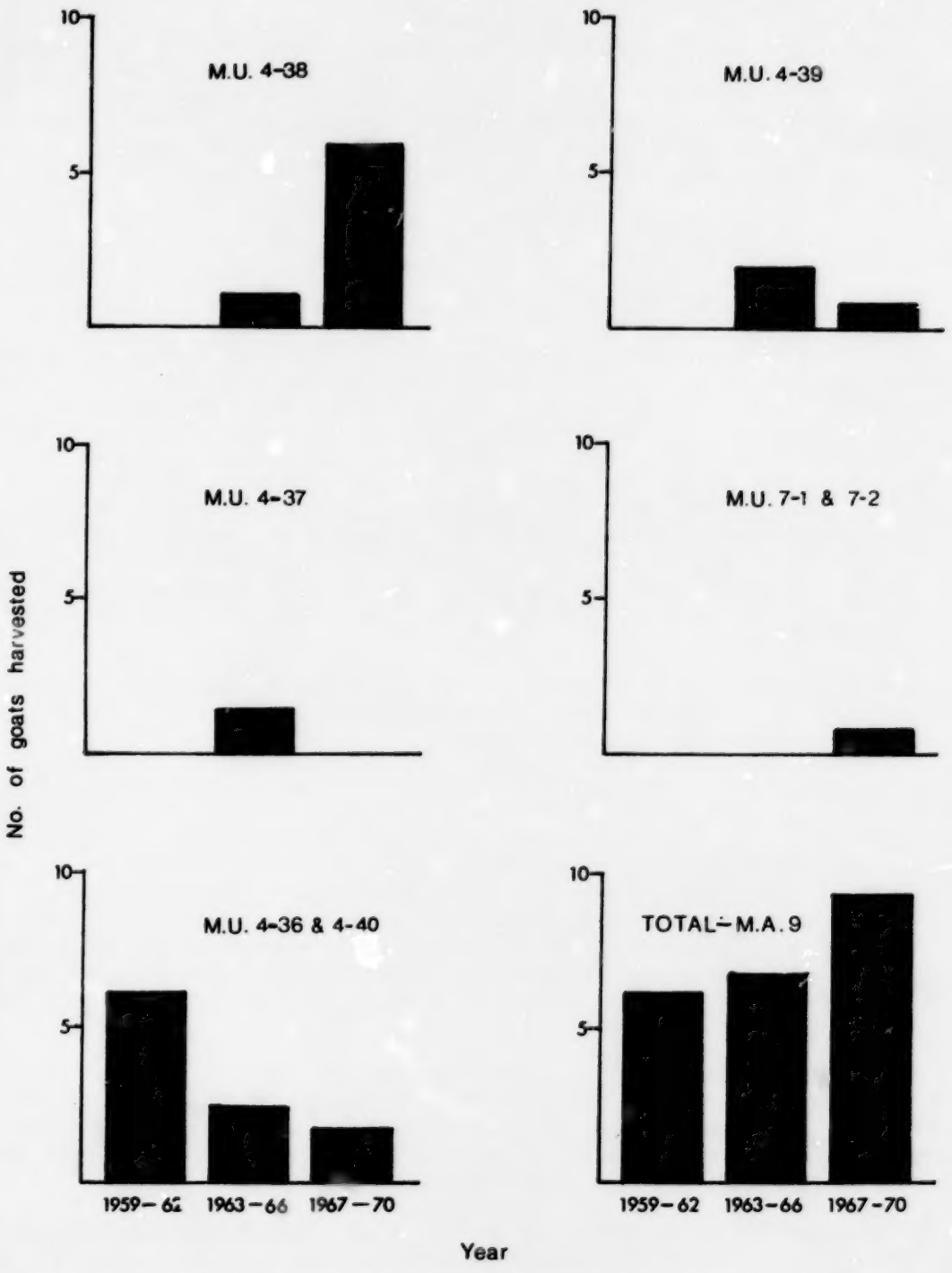

Fig. 7. Goat harvest distribution by Management Unit in M.A. 9.

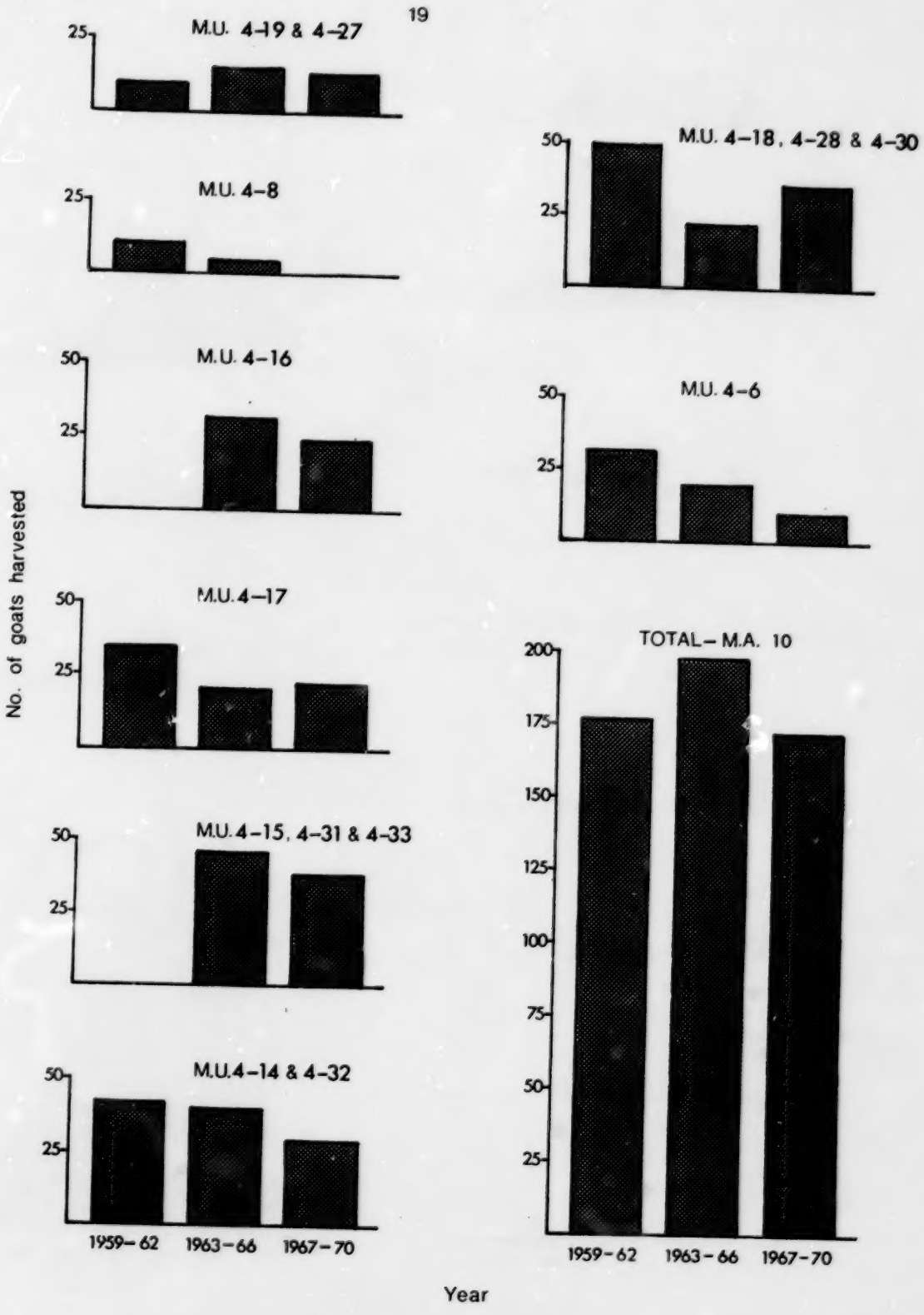

Fig. 8. Goat harvest distribution by Management Unit in M.A. 10.

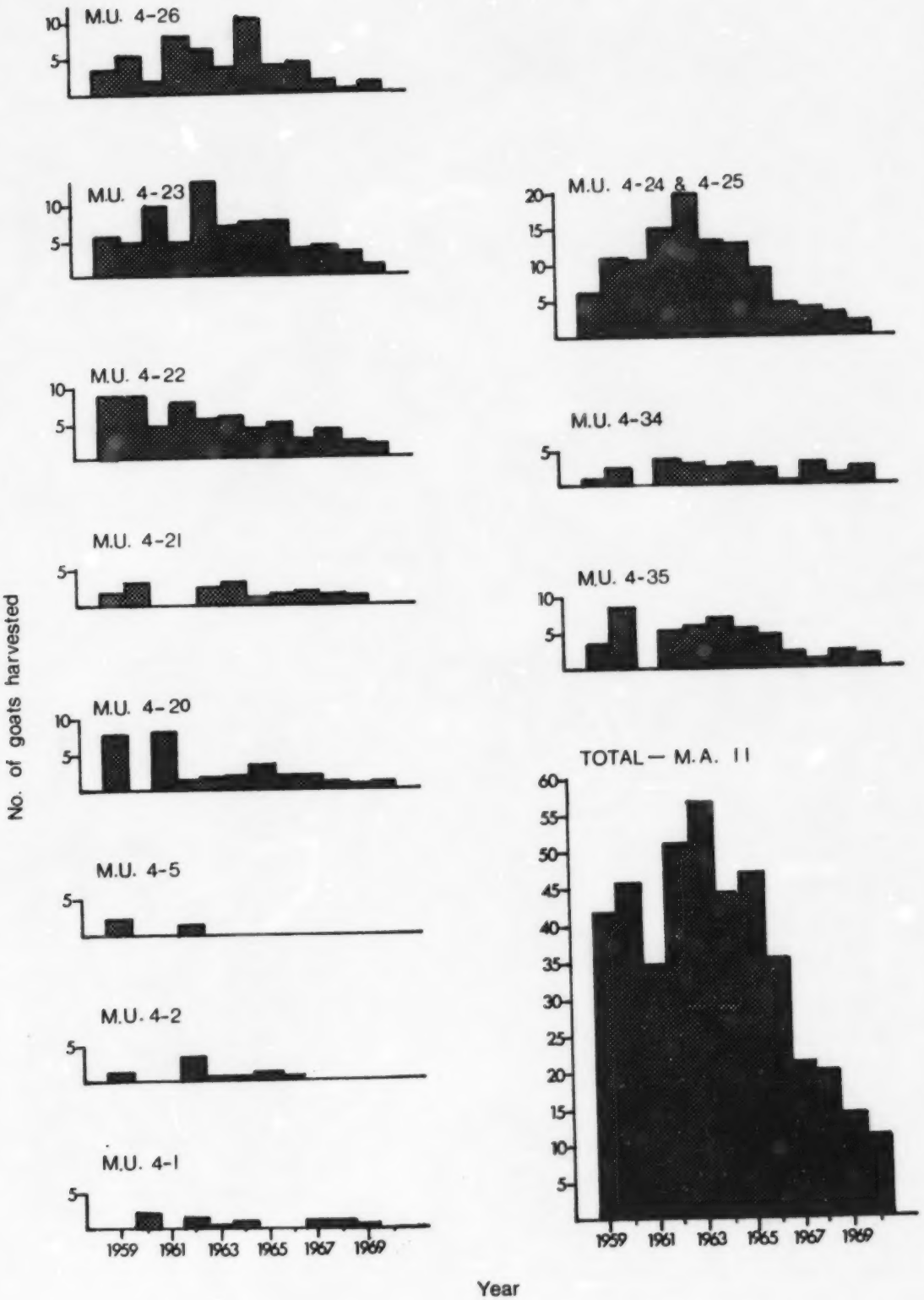

Fig. 9 Goat harvest distribution by Management Unit in M.A. II.

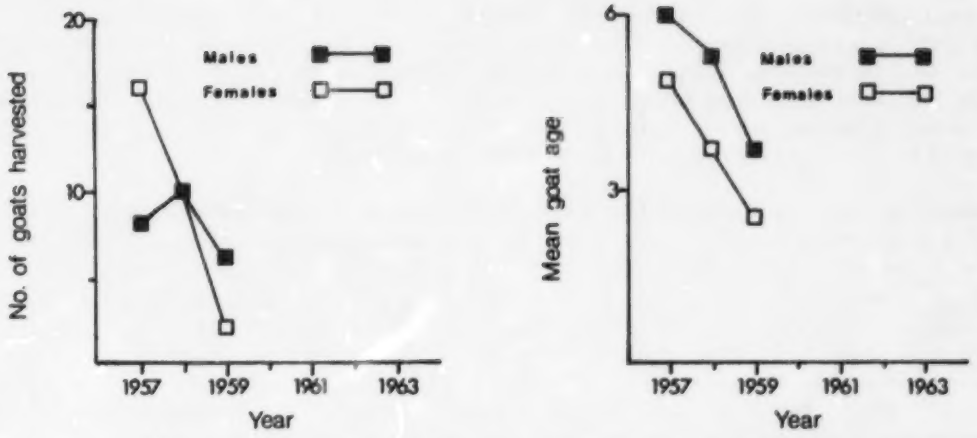

Fig.10. Estimated resident goat harvest and mean age of harvested goats in the Granby watershed.

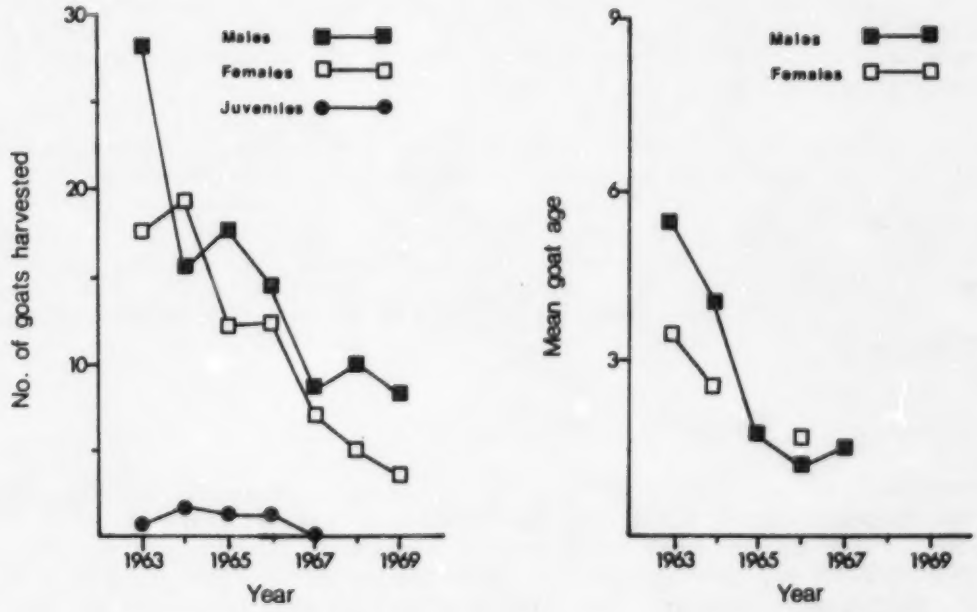

Fig.11. Estimated resident goat harvest and mean age of harvested goats in the Rocky Mountains, M.U.'s 4-21 to 4-25.

Purcells. However, for 1963 to 1967, the majority of the harvest came from the White River Reserve, and we felt that these data effectively represent the fate of the White River herd. In 1963, the first year the area was opened, there was a strong selection for males, particularly older ones up to 8 1/2 years. In 1964, the male harvest declined drastically and hunters shifted to the female segment. In 1965, the female kill declined as that segment of the population was reduced. Mean ages continued to decline. In 1966, only four years after the Reserve was opened, all animals checked were less than 2 1/2 years old. It seemed obvious to us that we had allowed a massive exploitation of a highly vulnerable population. Unfortunately, accurate census data were not available.

However, other examples of the exploitation of goat populations were available. In the Highwood watershed in Alberta, a population of 140 to 175 goats was reduced to 25 to 30 between 1955 and 1965. Two small, isolated herds were completely wiped out (Jamieson 1969). Kerr (1965) documented the decline of a herd on Mt. Hamell, also in Alberta, following the development of access for coal exploration. That herd was reduced from over 80 animals to 15. In the Ashnola, a nine day season over each of three years, 1963 to 1965, also resulted in a significant reduction of that herd. There is some evidence to indicate that similar exploitations occurred in the Fernie area around 1900 (Hornaday 1906) and, in the 1920's, in the Boundary area (Anon. 1973). Such is the record of goat management in western Canada.

In the Granby and White River examples given here, goat herds declined following the opening of these areas to hunting. However, the same decline occurred in non-reserve areas, as a result of uncontrolled access development. In 1952, access in the Kootenays was limited (Fig. 12) and most goat ranges were de facto sanctuaries. By 1962 (Fig. 12), a significant increase in access of 2600 km occurred, as well as a subsequent increase in goat harvest. However, it was the massive expansion of access, an additional 3000 km, between 1962 and 1972 (Fig. 12), opening up every major drainage in the southern Kootenays, that led to the exploitation of previously unhunted herds.

Industrial activity and access development can be related to increased goat harvests in several areas. Few goats were killed in the Mica Creek area until dam construction began; harvest then jumped to over 50 animals a year. The MacDonald Range goats were first exploited in 1962 when logging in Lodgepole Creek created new access. Access up the Elk River and its tributaries allowed over-harvest to occur there. In all areas, exploitation took place on a herd by herd basis. A herd made accessible by new roads would be decimated; then, as roads were pushed further back, new herds became accessible and were, in turn, decimated.

The Distribution of Harvest Over the Season

A further analysis was made, using returned Hunter Sample questionnaires, to determine the harvest rate for male and female goats (Figs. 13 and 14). The high, early season harvest in the high country was expected; however, a second peak occurred in mid-October, probably due to increased hunter effort during a period when other species were comparatively unavailable. By this time, the elk rut was finished, and deer, moose, and elk had not yet been forced out of the high country by deep snow.

Females predominated in the harvest up to September 15, after which males made up most of the harvest. Hebert (1967) found that females used licks later in the summer than males and, as a reuslt, were often shot on accessible licks during

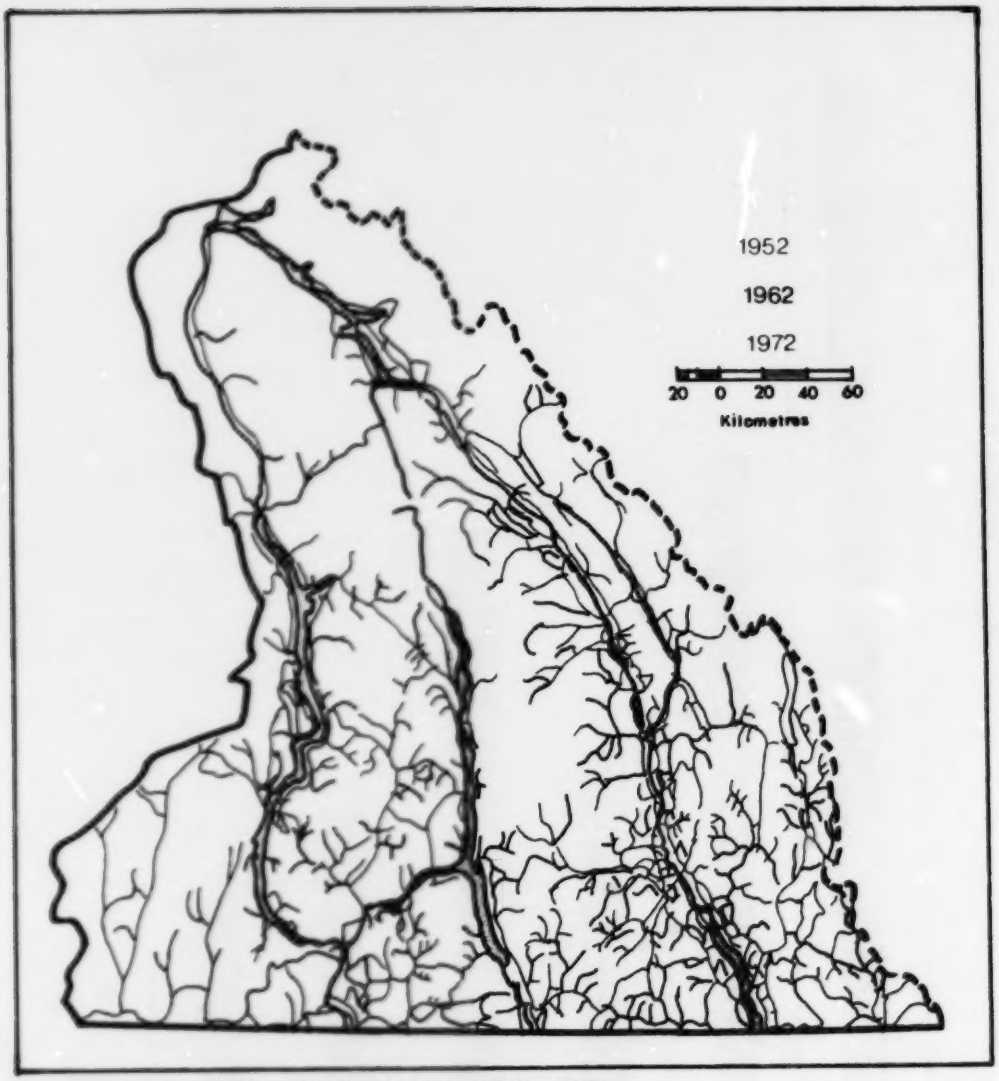

Fig. 12. Access roads in the Kootenays, 1952 - 1972.

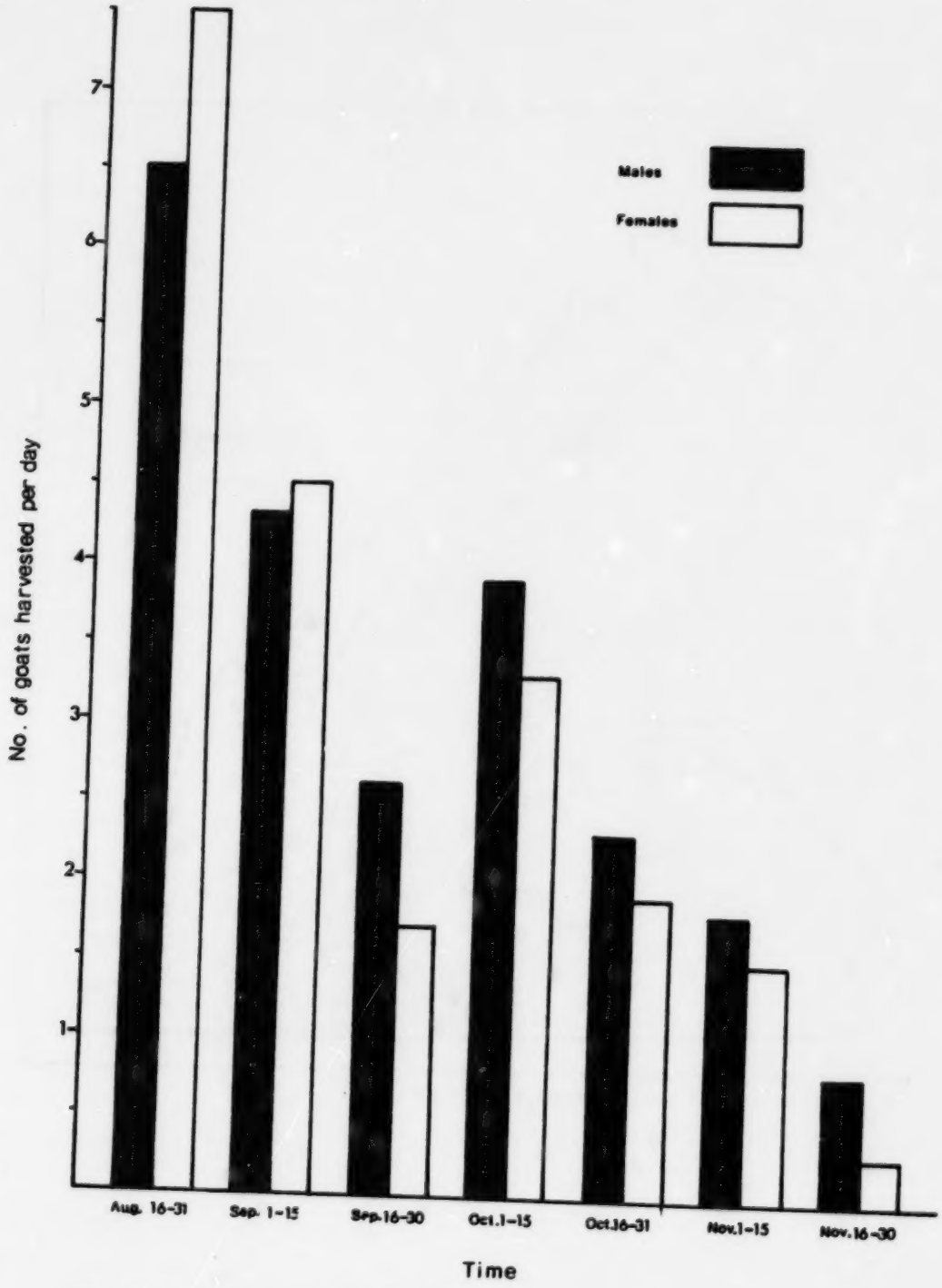

Fig. 13. Estimated resident goat harvest distribution over the hunting season, 1963—1966.

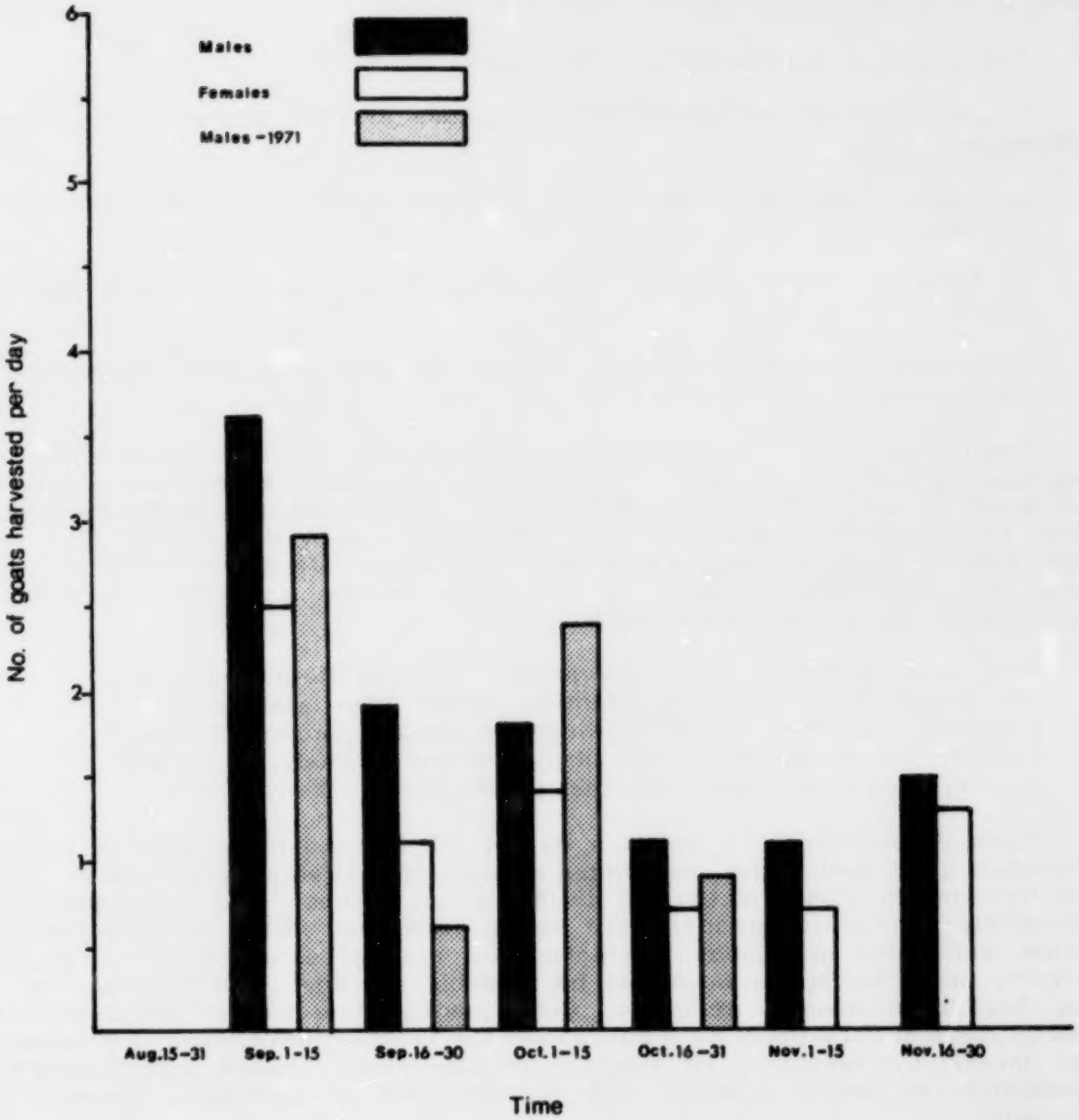

Fig. 14 . Estimated resident goat harvest distribution over the hunting season, 1967–1970 and 1971.

early seasons in late August and early September. This would appear to be substantiated by the large harvest taken in the Purcell Mountains in 1965 when the season opened very early (August 21), since there were several accessible licks in that range. However, between 1967 and 1970, the trend continued, despite later season openings (September 7, 11, and 16). This would indicate that other factors are involved - probably the greater visibility and accessibility of nannie-kid groups, as opposed to the males which are solitary at that time of the year and tend to remain in higher, rougher country.

The Effects of Harassment on Productivity

A goat questionnaire distributed to guides in 1969 produced the following comments:

A. Rosicky (Galbraith Creek) "...as far back as 1957, there were few young in the fall..."

D. Anderson (Dutch Creek) "...we have, in the past few years, seen some mighty poor kid crops..."

E. Goodwin (Tanglefoot Creek) "...there are some years that the reproduction was practically nil for some reason..."

Discussions with sportsmen and Conservation Officers confirmed lower reproduction rate. Though in some years, the lower reproduction could be attributed to winter severity, it could also be attributable to harassment resulting from heavy hunting pressure. The effects of human disturbance have been described by Zigunov (1961) for reindeer and similar effects for other ungulates have been postulated by Geist (1970). Goats may be especially susceptible to disturbance. As pointed out by Geist:

> "For social species in which individuals have long life expectancies, low reproductive rates, a retention rather than a dispersal of juveniles and which inhabitat widely dispersed patches of stable habitat, the alienation from available habitat is likely to be most severe, as are, probably, the other effects of disturbance."

Goats develop large fat deposits during the fall and these deposits probably provide a great deal of the over-winter energy requirements of the animal. Given the three-month season of the late 1960's, it was probable that many goat herds (especially nannie-kid groups) were driven from their prime habitat, the sub-alpine and alpine grasslands, to higher and rougher escape terrain. In such terrain, prime foodstuffs would not be available and energy intake over the fall may have been severely reduced. Consequently, this habitat denial and high energy costs of harassment by hunters over the fall may have meant that goats did not develop the necessary fat reserves to over-winter. Such animals would be susceptible to winter stresses and mortality due to predation, disease, and accident.

Reproduction might also have been affected. Harassment during November may have interrupted breeding, though it is unlikely that sufficient hunting took place at that time of year to have any significant effect. However, dispersal of herds during intense hunting in October may have made it difficult for goats to re-form social groups for breeding. A more significant effect would be among females

denied fat reserves by harassment in the fall causing severe weight loss and resorption of the embryo during the winter. Post-natal losses would also be high due to poor milk production, teat development, and maternal care among females just recovering from severe winter stress. The end result would be low production and recruitment in heavily hunted herds. These losses due to stress would be in addition to the more direct results of hunting, loss of recruitment through a high female kill, and reduced productivity from a depressed age class structure. All of these factors acted to accelerate the decline of intensively hunted goat herds.

DISCUSSION AND CONCLUSIONS

During the span of this study, no evidence was gathered (data included that reported here as well as preliminary studies on habitat decline, severe weather, and disease) to indicate the goat population decline in the Kootenay Region could be attributed to anything other than over-harvest.

The Fish and Wildlife Branch, as the managing agency, must accept responsibility for the decimation of this resource - the goat. However, up to 1970, there were no discernible trends in the available management data, and not until 1972, and an extensive reanalysis of the Hunter Sample data, was it possible to document the exploitation of goat herds that occurred. These exploitations occurred as the result of uncontrolled access development, compounded by a lack of management data.

The real basis for the decline was:

1. A proliferation of uncontrolled access. The continuous expansion of industrial roads and thus, increased access to goat ranges resulted in a progressive decimation of goat herds. This exploitation, as opposed to cropping of the animal, was a repetition of events observed elsewhere and a scene still being repeated in northern B.C. and the Yukon.

2. A philosophy of maximum harvest. With maximum sustained yield as a major goal among biologists and administrators of the period, it was difficult to justify the super-conservative management that goats require. At that time, biologists were unaware of the vulnerability of this species. The apparent direct effects of female harvest on reproduction and survival in this species may render invalid many generally accepted principles in wildlife management.

3. Insufficient management input. The Regional Wildlife Biologist did not have the time or the resources to analyze effectively or to interpret the available data, especially since goats had to be assigned a low priority when compared to the problems faced by other species. This problem was amplified by the lack of precision and accuracy in the available management data. The data, calculated on a M.A. basis, were insufficient to demonstrate that exploitation was occurring. Decisions were possible only on a subjective basis - the opinions and concerns of hunters. Later analysis indicated that it saved us from decimating goat herds still further, as was the case in Alberta (Quaedvlieg et al. 1974).

REFERENCES CITED

Anderson, N.W. 1940. Mountain goat study. Wash. Dep. Game. Biol. Bull. 2. 21pp.

Anonymous. 1973. Game Commission reports: mountain goat, 1915 to 1956. B.C. Fish and Wildl. Branch, Cranbrook. 6pp, mimeo.

Boddicker, L., E.J. Huggins, and A.H. Richardson. 1971. Parasite and pesticide residues of mountain goats in South Dakota. J. Wildl. Manage. 35: 94-103.

Brandborg, S.M. 1955. Life history and management of the mountain goat in Idaho. Idaho Dep. Fish and Game, Boise. 142pp.

Coleman, A.P. 1912. The Canadian Rockies: new and old trails. Harry Frowde, Toronto.

Collins, R. 1969. Big game inventory and habitat classification of the mountain and foothill portions of the Sheep, Kananaskis, and Bow River drainages. Alta. Fish and Wildl. Div.. 60pp, mimeo.

Cowan, I.M. 1951. The diseases and parasites of big game mammals of western Canada. Proc. Ann. Game Comm. 5: 37-64.

DeBock. E. 1971. A report on the Willmore Wilderness Goat Project. Alta. Fish and Wildl. Div.. 40pp, mimeo.

Demarchi, R.A., and D.A. Demarchi. 1969. Status of the Rocky Mountain bighorn in the East Kootenay. Wildl. Rev. 4(4): 10-13.

Edwards, R.Y. 1956. Snow depth and ungulate abundance in the mountains of western Canada. J. Wildl. Manage. 20: 159-168.

Geist, V. 1970. A behavioural approach to the management of wild ungulates. Pap. presented at Brit. Ecol. Soc. Symp. on the Sci. Manage. of Plant and Animal Commun. for Conserv. 22pp, mimeo.

Grohman, B. 1900. Sport and life. Horace Cox "Field" Off., Windsor House, Bream's Bldg., London.

Hebert, D.M. 1967. Natural salt lick as a part of the ecology of the mountain goat. M.S. Thesis. Dep. Zool., Univ. of B.C., Vancouver.

Hebert, D.M., and I.M. Cowan. 1971. White muscle disease in the mountain goat. J. Wildl. Manage. 35: 752-756.

Hitchcock, C.L., and A. Cronquist. 1973. Flora of the Pacific Northwest. Univ. Wash. Press, Seattle. 730pp.

Hjeljord, O. 1973. Mountain goat forage and habitat preference in Alaska. J. Wildl. Manage. 37: 353-362.

Holland, S.S. 1964. Landforms of British Columbia. A physiographic outline. B.C. Dep. Mines and Petroleum Resources. Bull. No. 48. Queen's Printer, Victoria. 139pp.

Hopwood, V.G. 1971. David Thompson travels in western North America, 1794-1812. MacMillan of Canada, Toronto.

Hornaday, W.T., and J.M. Phillips. 1906. Camp-fires in the Canadian Rockies. Charles Scribner and Sons, New York.

Jamieson, B. 1969. Big game inventory and habitat classification of the mountain and foothills portions of the Highwood, Elbow and Ghost River drainages. Alta. Fish and Wildl. Div. 78pp, mimeo.

Kerr, G.E. 1965. The ecology of the mountain goat in west central Alberta. M.S. Thesis, Univ. of Alta., Edmonton.

Kerr, G.R., and J.C. Holmes. 1966. Parasites of mountain goats in west central Alberta. J. Wildl. Manage. 30:786-790.

Kuck, L. 1973. Mountain goat ecology. Job Progress Rep., Proj. W-144-R-4. Idaho Fish and Game Dep. 68pp.

Lentfer, J.W. 1955. A two year study of the Rocky Mountain goat in the Crazy Mountains, Montana. J. Wildl. Manage. 19:417.

McCrory, W.P. 1965. Study of natural salt licks used by mountain goats and bighorn sheep in Jasper National Park. Prelim. Rep., Can. Wildl. Ser. 55pp, mimeo.

Ogilvie, R.T. 1968. Plant ecology lecture notes. Univ. of Calgary, Alta. 9pp, mimeo.

Outram, J. 1905. In the heart of the Canadian Rockies. The MacMillan Co., New York.

Quaedvlieg, M.T., M. Boyd, G. Gunderson, and A. Cook. 1973. Status of the Rocky mountain goat in the Province of Alberta. Special Rep., Alta. Fish and Wildl. Div., Dep. Lands and For. 32pp, mimeo.

Wheeler, A.A. 1905. The Selkirk Ranges. Ottawa Gov. Printing Bur.

Wilcox, W.D. 1906. The Rockies of Canada. G.P. Putnan and Sons, New York.

Zigunov, P.S., ed. 1961. Reindeer husbandry. U.S. Dep. Commerce, Springfield. (Eng. translation from Russ.).

Appendix A. Seasons, bag limits, restrictions, and closures for mountain goat, 1950-1974.

Year(s)	Management Area (M.A.)	Season	No. of Days in Season	Bag Limit	Restrictions and Closures
1950	All	Sept. 1 - Nov. 30	91	2	One year plus
1951 - 1954	All	Sept. 1 - Nov. 30	91	1	One year plus
1955	9, 10	Sept. 1 - Nov. 30	91	2	One year plus western portion of M.A. 9, one goat only.
	11	Sept. 1 - Nov. 30	91	1	One year plus
1956	9, 10	Sept. 1 - Dec. 2	93	2	One year plus western portion of M.A. 9, one goat only.
	11	Sept. 1 - Dec. 2	93	1	One year plus
1957	All	Sept. 1 - Dec. 1	92	2	One year plus
1958	9, 10	Sept. 1 - Nov. 30	91	2	One year plus western portion of M.A. 9, one goat only.
	11	Sept. 1 - Nov. 30	91	1	One year plus
1959	All	Sept. 1 - Nov. 30	91	2	One year plus
1960	All	Sept. 1 - Dec. 4	95	2	One year plus
1961	All	Sept. 1 - Dec. 3	94	2	One year plus
1962	All	Sept. 1 - Dec. 2	93	2	
1963	All	Aug. 31 - Dec. 1	94	2	Closure - M.A.10 west of Columbia south of Hwy. 3
1964	All	Aug. 29 - Nov. 29	93	2	Closure - M.A.10 west of Columbia south of Hwy. 3
1965	9, 11	Aug. 21 - Nov. 28	100	2	
	10	Aug. 28 - Nov. 28	93	2	Closure - west of Columbia, south of Hwy. 3
1966	9	Sept. 3 - Nov. 27	86	2	
	10, 11	Sept. 3 - Nov. 27	86	1	Closure-M.A. 10, west of Columbia south of Hwy. 3
1967	10	Sept. 11- Nov. 16	77	2	Closure - west of Columbia, south of Hwy. 3
	9, 11	Sept. 11- Nov. 16	77	1	
1968	9	Aug. 31 - Dec. 1	93	2	
	10	Sept. 7 - Dec. 1	86	1	Closure - west of Columbia, southeast of Kettle Valley, and drainages of Kokanee Glacier Prov. Park

	11	Sept. 7 - Dec. 1	86	1	Closure - Moyie except from Oct. 11 - 16
1969	9	Aug. 30 - Nov. 16	79	1	East of Columbia south of Waitabit Creek only
	10	Oct. 11 - Oct. 26	16	1	Closure - south-west portion of M.A. 10
	11	Sept. 13 - Nov. 16	65	1	Males only, except from Oct. 11-Nov. 16. Closure - Horse-thief, Moyie, Stoddart East, Upper Elk, Goat-haven
1970	9, 11	Sept. 5 - Nov. 29	86	1	Males only in M.A. 11. Closure-M.A. 11 Moyie, Stoddart Upper Elk
	10	Sept. 12 - Nov. 29	79	1	Males only. Closure west of Kootenay Lake and River, south of Kaslo - New Denver road and Hwy. 6
1971	9	Sept. 4 - Nov. 7	65	1	
	10	NO SEASON			
	11	Sept. 4 - Nov. 29	58	1	Males only. Closure - Moyie Stoddart, Upper Elk
1972	9	Sept. 9 - Oct. 1	23	1	
	10, 11	NO SEASON			
1973	9	Sept. 8 - Oct. 7	29	1	Closure - Waitabit and Marl Creeks
	10, 11	NO SEASON			
1974	9	Sept. 7 - Oct. 6	29	1	Closure - Waitabit and Marl Creeks
	10, 11	NO SEASON			

Appendix B. Estimated distribution of mountain goat hunters by resident area, 1964 - 1971.

Management Area	Year	Vancouver Island	Lower Mainland	Okanagan	Kamloops	Chilcotin-Cariboo	North B.C.	Peace River	Kootenays	Upper Mainland Coast	Total
9	1964	4	2			12			35		53
	1965		3			9			23		35
	1966	2				5			19		26
	1967		2				3		54		59
	1968			5			3		60		68
	1969			8	14		3		54		79
	1970	2	10		4		5		52		79
	1971		7	8	15	2			40		72
10	1964		7			8	4		151		170
	1965		4			26			139	3	172
	1966		5			7			166		178
	1967								122	15	137
	1968		3	11					157		171
	1969		6	6	4				85		101
	1970	2			2				76		80
11	1964	31	96			75	9		831		1,042
	1965	27	97			92	3		885		1,110
	1966	7	44			51	2		776		880
	1967	5	17			50	3		569	15	659
	1968	7	39	41	20		6		471		584
	1969	4	31	30	18	2	3	5	377		470
	1970	7	45	30	6		10		396	4	498
	1971		32	28	8		7		366	6	447

Appendix C. Resident and alien non-resident mountain goat harvest in M.A. 11, 1956 - 1971.

Year	Resident Harvest	Alien Non-resident Harvest[1]	Total Harvest	% Non-residents
1956	201	90	291	31
1957	525	187	712	26
1958	356	104	460	23
1959	288	108	396	27
1960	454	164	618	26
1961	495	122	617	20
1962	482	126	608	21
1963	566	204	770	26
1964	469	117	586	20
1965	470	108	578	19
1966	351	118	469	25
1967	211	114	325	35
1968	199	106	305	35
1969	140	82	222	37
1970	110	56	166	34[2]
1971	95	73	168	43[2]
Total	5,412	1,879	7,291	26
Mean	338	117	456	

[1] summarized from Guide Returns

[2] males only

Appendix D. Estimated resident mountain goat harvest for M.A.'s 8 to 11, 1950 - 1974.

Year	% Sample	Reported Harvest	Estimated Harvest MA 8	MA 9	MA 10	MA 11	Estimated Total Harvest (8,9,10,11)	Estimated Total Harvest for Kootenay Region (9, 10, 11)
1950	4.9	(13)	(12)	(8)	(23)	(222)	265	(253)
1951	4.6	(7)	(7)	(4)	(14)	(127)	152	(145)
1952	6.6	30	(20)	(13)	(40)	(382)	455	(435)
1953	8.9	37	(19)	(12)	(36)	(349)	416	(397)
1954	9.2	21	(10)	(7)	(20)	(191)	228	(218)
1955	9.4	18	(9)	(5)	(17)	(161)	192	(183)
1956	7.5	18	(11)	(7)	(21)	(201)	240	(229)
1957	8.3	52	(28)	(19)	(54)	(525)	626	(598)
1958	14.8	63	(19)	(13)	(37)	(356)	425	(406)
1959	6.1	20	(16)	(10)	(30)	(288)	(344)	328[1]
1960	6.0	31	(25)	(16)	(47)	(454)	(542)	517
1961	14.0	79	(27)	(18)	(51)	(495)	(591)	564
1962	6.4	35	(25)	(17)	(50)	(482)	(574)	549
1963[1]	59.3	391	20	24	71	566[2]	681	661
1964	54.2	284	33	21	44	469	567	534
1965	46.5	242	10	5	42	470	527	517
1966	42.8	175	19	18	42	351	430	411
1967	38.5	100	14	19	44	211	288	274
1968	34.9	104	12	23	78	199	312	300
1969	48.0	99	12	23	37	140	212	200
1970	49.7	72	9	27	14	110	160	151
1971			2	2	0	95	99	97
1972			12	12	0	0	24	12
1973			0	7	0	0	7	7
1974			0	7	0	0	7	7

[1] Estimated total for 9, 10, 11 - Ave. of 95.5% of 8, 9, 10, 11 harvest for eight year period 1963 - 1970.

[2] M.A. 11 - Ave. of 87.8% of 9, 10, 11 harvest for four year period 1963 - 1966. Also M.A. 10 = 9.1% and M.A. 9 = 3.1%.

Appendix E. East Kootenay Game Checks, Goats, 1955-71.

Year	Sex	Juv.	1 1/2	2 1/2	3 1/2	4 1/2	5 1/2	6 1/2	7 1/2	8 1/2	Clas. adult [1]	Clas. sex [2]	Total Check	Males/100 Check	Females H. Sample
1955	M										0	2	2	-	-
	F										0	0	0	-	-
1956	M										0	1	6	-	-
	F										0	0	0	-	-
1957	M										1	2	10	100	-
	F										2	2	-	-	-
1958	M										-	1	6	50	-
	F										1	2	-	-	-
1959	M		1								0	1	4	33	-
	F		1		1						1	3	-	-	-
1960	M			1	1						1	4	8	200	-
	F		1								1	2	-	-	-
1961	M			1							1	2	7	100	-
	F					1					-	2	-	-	-
1962	M				2	1			1	1	7	14	27	108	127
	F	3	2	1							4	13	-	-	-
1963	M	1	1		1	1	1	2	3	1	7	21	35	150	128
	F	1		1	1		2				6	14	-	-	-
1964	M	2	1	1	1	2	2	1		1	21	35	63	117	108
	F	1	3	0	3		1				16	29	-	-	-
1965	M		2	1							17	30	47	177	145
	F	1									12	17	-	-	-
1966	M	2	1	1							13	21	41	105	137
	F	1	2	2							13	20	-	-	-
1967	M	1		1							7	16	24	200	169
	F			1							7	8	-	-	-
1968	M					2			1		0	6	8	300	148
	F										0	2	-	-	-
1969	M		1								5	6	8	300	306
	F										2	2	-	-	-
1970	M				1		2	1		1	0	5	5	-	-
	F				NO SEASON						-	-	-	-	-
1971	M				NO SEASON						-	-	-	-	-
	F				NO SEASON						-	-	-	-	-

[1] Classified as adult only, not aged by annuli
[2] Classified as male or female

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